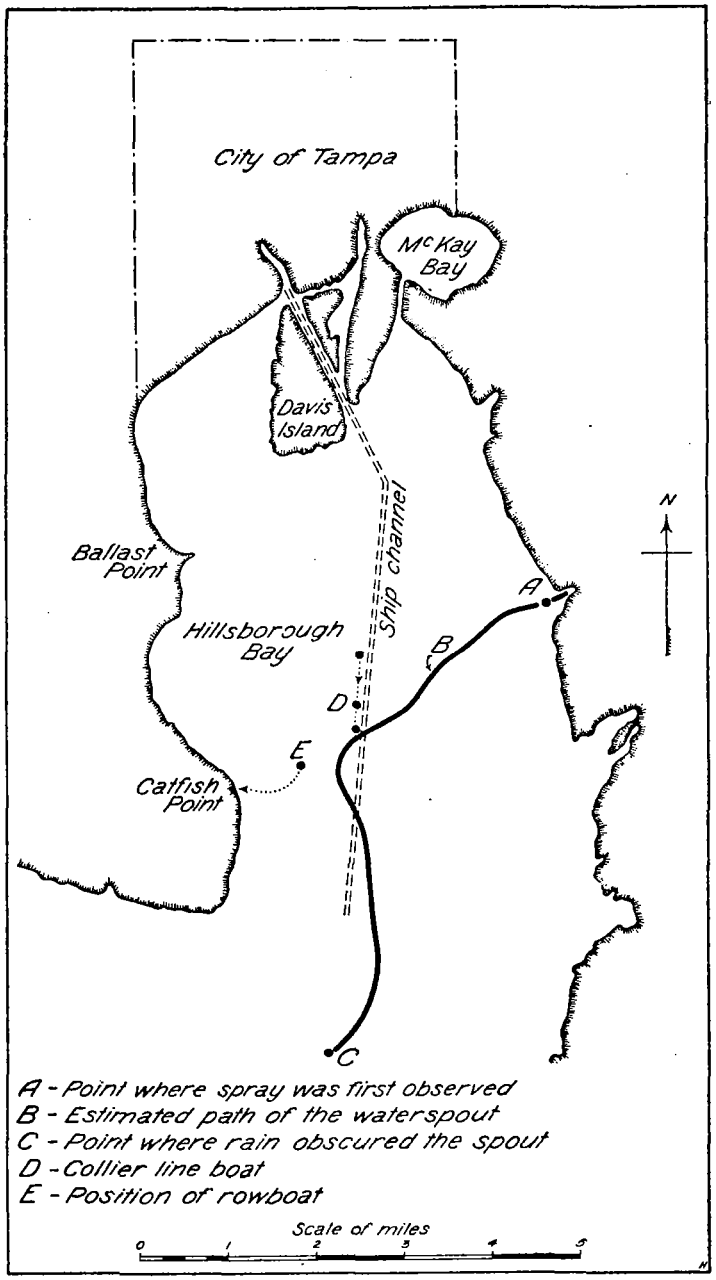

FIGURE 3.—Hillsborough Bay, Tampa, Fla., showing path of the waterspout of April 2, 1929, the course of the steamship *City of Tampa*, and the position of the observer. From drawing by Mr. George V. Fish, of the Tampa Weather Bureau Station

It now remained under observation until a rainstorm, coming between it and the steamer, obliterated it from further view.

"A tremendous roaring accompanied the spout," said Mr. Fish, although he did not hear it, this information being later given to him by Captain Borden. "A solid cone of water rose up in the center of the spray to a height of from 15 to 18 feet. Around this cone the spray was being whirled, the rays from the setting sun producing on it all the colors of the rainbow."

The following generalizations were arrived at by the observers:

(1) The whirl on the water was visible before the funnel appeared in the cloud and before any whirling motion in the cloud was observed.

(2) The spout dropping from the cloud and the one rising from the spray developed simultaneously and met in midair.

(3) The forces at work were so strong that the pressure at the center was lowered to a point whereby the water was pressed up to a height of 15 or 18 feet, and mud and seaweed were drawn up from the bottom of the bay through 15 feet of water.

(4) The path of mud left by the spout is the best check on the diameter of the spiral at the base. The path on the water was estimated to be about 50 feet wide.

(5) The waterspout preceded the rain by from 3 to 5 miles. After the base spray passed the bow of his ship, Captain Borden steamed directly under the great funnel in the cloud to observe the mighty whirling. All was in brilliant sunshine at the time.

(6) The water spray was drawn so rapidly to the cloud that the spiral upward movement was plainly evident.

(7) The circulation on the water was clockwise.

(8) No accurate check on the duration of the spout is obtainable, since it was continuing unabated when the rain hid it from view.

Remarking upon the frequency of the phenomenon in Hillsborough Bay, the man from whom Mr. Fish rented the boat "said that he had seen seven waterspouts during one thundershower the previous summer."

Mr. Fish mentioned "another experience had by Captain Borden some years ago with a sailing vessel in a waterspout. It came upon him rapidly, and while he made all haste to lower and secure his canvas, he was unable to complete the work before the waterspout engulfed the ship. It stripped his booms, breaking some, and wrecked other parts of his deck gear, as the vessel pitched and spun about, finally to emerge deluged with water."

EVIDENCE OF PROLONGED DROUGHTS ON THE COLUMBIA PLATEAU PRIOR TO WHITE SETTLEMENT

551.573 (79)

By OTIS W. FREEMAN

Ellsworth Huntington, A. E. Douglass, and others have presented much evidence favoring wet and dry years alternating over centuries of time in the southwestern United States. The following note presents proof of prolonged drought in the past on the Columbia Plateau in the Northwest.

A large number of lakes exist on the lava plateau southwest of Spokane. These occupy basins in channels of the "scablands." According to J. H. Bretz, of the University of Chicago, a great flood was produced by the very rapid melting of a continental glacier. The swift torrents scoured away the surface soil and the resulting bare basaltic bedrock is locally called "scabrock." The numerous interlaced channels once filled by flood waters are called "scablands." Basins eroded by the flood are often occupied by lakes which vary in size from mere ponds in potholes to deep, rock walled lakes 10 miles in length.

Most of the lakes have no visible outlet. Many are highly alkaline, especially in the drier sections of the Columbia Baisn. Typically the lakes occupy elongated basins with steep cliffs descending abruptly into deep, rock water, but in places along the shores of the lakes, particularly at their heads, material has been deposited, making swamp or shallow water. Decreased rainfall causes the water level to sink and trees can grow on the

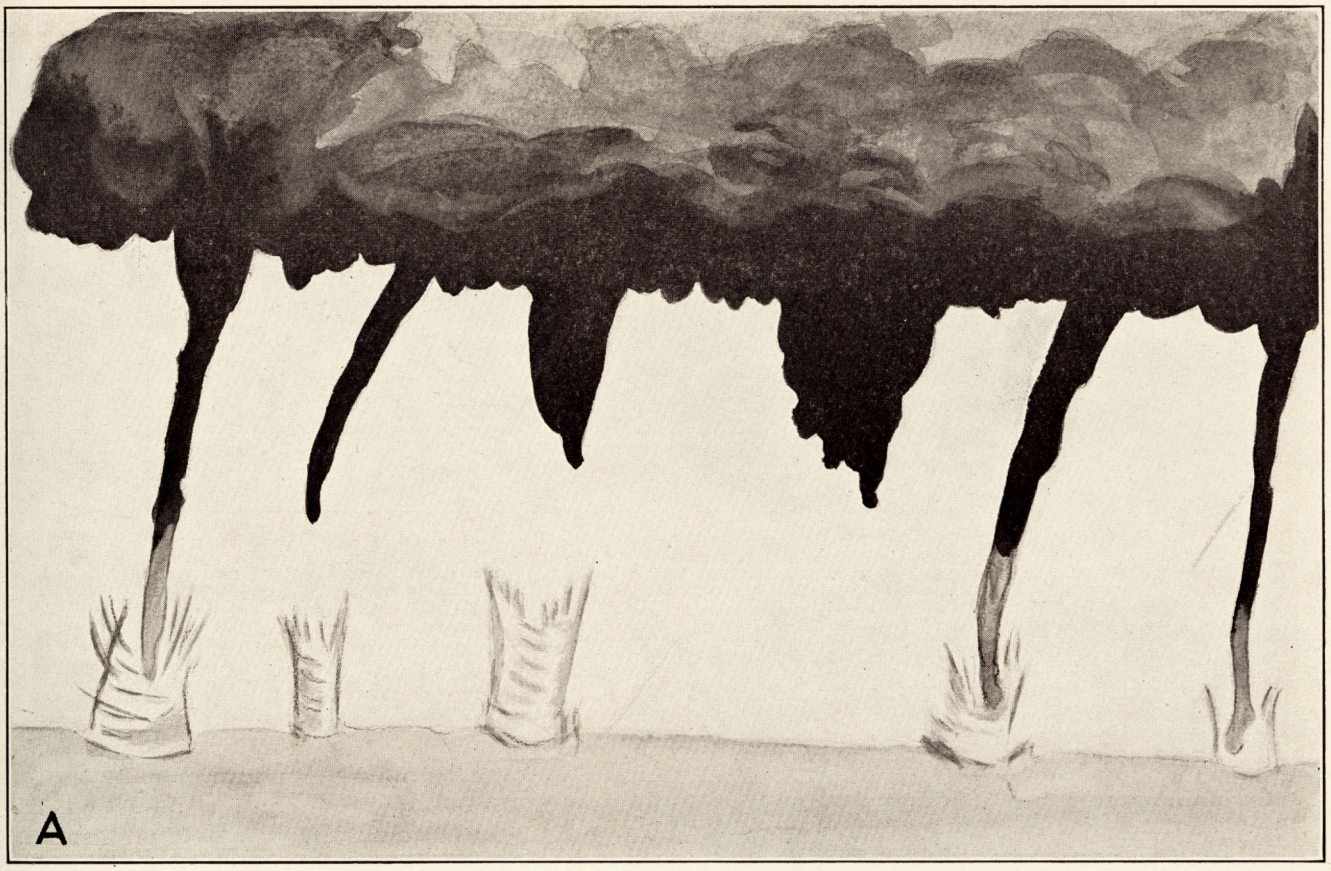

FIGURE 1.—Simultaneous waterspouts observed in Malacca Strait, February 17, 1929. From drawing made on board the British steamship *Flowergate*

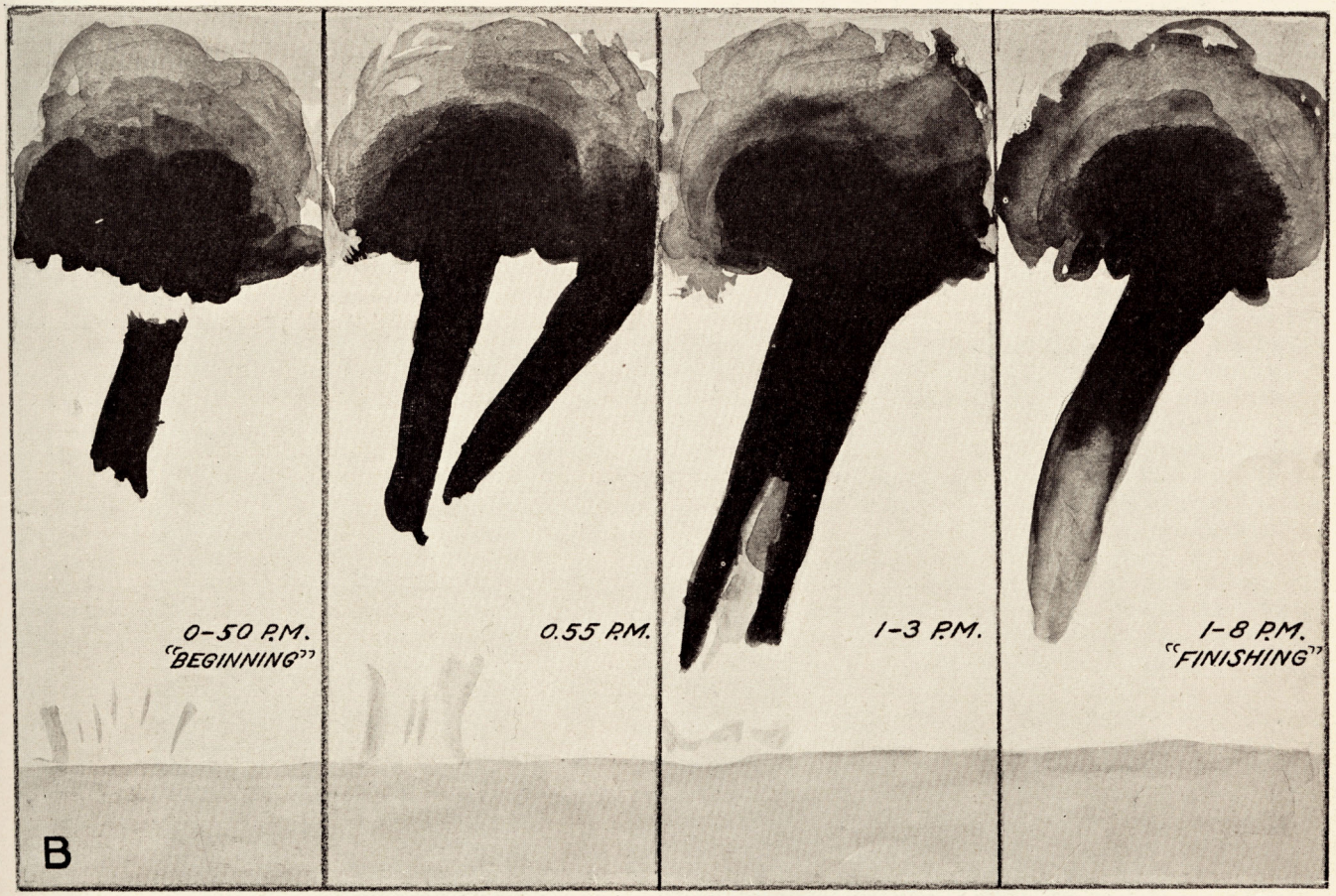

FIGURE 2.—Successive appearances, from 12.50 p. m. to 1.08 p. m., of a waterspout observed in Malacca Strait, February 17, 1929. From drawing made on board the British steamer *Flowergate*

(To face p. 250)

FIGURE 1.—Shore of Granite Lake, Spokane County, in 1926. The lake level was the lowest since white settlement about 60 years ago, yet stumps 1 to 2 feet in diameter, with over 100 rings of growth were standing in the lake. The trees are yellow pine which grow on well-drained soil. A further drop of 5 to 10 feet in lake level would be necessary for the pines to again grow in this situation. The climate must have been decidedly drier for over a century to have produced such low-water level

FIGURE 2.—Shore line of Silver Lake, Spokane County, in 1926. Pines and willows have migrated to the lower shore line which is about 40 feet below that in 1915 before 10 years of drought began. Part of the drop in Silver Lake resulted from pumping water for irrigation and water supply of the city of Medical Lake. The men are standing on deposits of calcareous tufa

FIGURE 3.—Shore of Silver Lake, Spokane County, in 1928. Willows killed by rising lake water. The level of the lake rose in part because pumping from it for irrigation and other uses ceased in 1926, but more because of heavy rainfall in 1927–28. The change of level shown in these photographs is greater than for other lakes because of the pumping, but all lakes in the "scablands" were at low levels in 1926 from drought and at high levels in 1928 because of abundant rainfall. Silver Lake rose nearly 20 feet in two years. Other lakes rose about one-half or one-third of this amount

FIGURE 4.—Shore of Granite Lake, summer of 1926. Note the stumps that had been long under water exposed by the shrinking of the lake resulting from more than a decade of dry years. Some of these stumps were again surrounded by water in 1928, by the rising lake water, the result of heavy rains and snows. In 1889, according to George Craig, of Cheney, the large rock at the left of the view was an island whose top was just above the water surface. The point at which the dead pines decayed and broke off leaving the present stumps would be at about the level of the lake in 1889. Wood, of course, decays most readily at the point where it is alternately wet and dry. Young pines are beginning to invade the mud flat beyond the stumps where the drainage is better. A wetter cycle in the future would drown the invaders and the story told by the stumps would be repeated

newly exposed land. Increased rainfall causes the lakes to rise and the trees are killed.

Stumps of dead trees were found by the writer standing in Granite Lake, Williams Lake, Medical Lake, Badger Lake, and many other lakes southwest of Spokane, during the summers of 1926 and 1927, when after 10 years of deficient rainfall the level of the lakes was the lowest known since the white man settled the country. Rings of growth proved some of the trees lived over a century, during such a prolonged drought period that lake levels were below anything known to-day. Since most lakes on the Columbia Plateau, except where the rainfall was too low for trees to have ever grown, contain stumps of trees killed by rising water; it is proof of a widespread drought period lasting over a century. The phenomenon being widespread can not be accounted for by a local cause that might temporarily have affected the level of one lake alone.

The time of occurrence of the prolonged drought, and whether more than one such period happened has not been determined.

Additional evidence for long drought in historic times comes from eastern Oregon. In the summer of 1926 Goose Lake, Malheur, and Harney Lakes almost disappeared after several exceptionably dry years. In the dried up lake bed well defined wagon ruts were found. It is supposed these were made by the wagon of some pioneer in the decade after 1840, as the floor of the lake had never been exposed since the region was permanently settled.

AGRO-CLIMATIC CONDITIONS IN RUSSIA[1]

551.58 (47+57)

By Prof. W. v. POLETIKA

[Berlin, Germany, 1928]

On account of the uniformity and enormous extent of the belt of the Russian plain and the almost complete absence of mountains the climate is the chief factor in landscape formation. With the flat conditions of Russia this develops in zone form mainly in the direction of latitude and is subject to the influence of solar and Atlantic climatic factors.

The orderly series of latitudinal climatic zones is accompanied by a corresponding arrangement of territories in which soil and vegetation on the one hand and sanitary, economic, and social conditions on the other are the same.

Almost one quarter of European Russia is waste land, whose geographic features, nature of soil, and character of climate—marked lack of warmth in the north and lack of water in the south—are altogether incompatible with any form culture; hence the presence of tundras in the north and the desert belt in the south are readily explained.

The climate of the flat part of Russia either shows the same characteristics detrimental to agriculture and necessitates recourse to primitive forms of farming in the northern Tayga (swampy forest) and in the southern steppes, or then it considerably hampers farming, as in almost all of the remaining parts of the middle forest and steppe regions, which comprise the greatest and best part of the arable surface of Russia.

The climatic extremes of the farming region are explained for the most part by extreme continentality and can be summarized as follows: (*a*) Marked change in temperature from summer to winter and from day to night; (*b*) in general, long-continued, severe winter, especially in eastern Siberia, and hot summer in the south; (*c*) scant amount of snow in Siberia and great extent of perpetually frozen ground, (*d*) lack of precipitation in southern and southeastern Europe, the region of most fertile soil; (*e*) dissimilarity of rainfall régime in the whole farming area, and lack of rain in the spring and early summer (even in the region of the Atlantic wedge of maximum precipitation of eastern Europe), which injures forage plants, clover, and alfalfa, so necessary in crop rotation; (*f*) extraordinarily short growing season of three to five months; and (*g*) droughts, hot winds, dust clouds, heavy downpours and hail in the south and southwest, and severe night frost over extended areas.

The climatic extremes prevent the permanent colonization of two-thirds of the Russian region and impose upon the cultivated vegetation the stamp of a type of weather very fickle and productive of small yields. Hence expenditures on intensive agriculture do not pay and extensive forms of farming are not supported.

Although it permits farming in the forest belt and in the steppes, the climate of Russia is on the whole not favorable to agricultural development, especially in comparison with western Europe, India, and China.

The climatic conditions make farming but little profitable in the greatest part of Russia; they hardly permit an extension of the farming area and make unattainable the raising of yields to the type found in western Europe, where the harvests are two to three times as great as those in Russia before the World War. Under present conditions on 96 per cent of small rural farms it is not possible to count upon farming as the sole factor in the commercial, economic, and social development of Russia.

For the further advance of Russia and for the easing of the struggle of man against natural conditions there must be a change to diversified farming of intensive type and a development of household industries.

Also, there must be development of mining in order that soil fertility may be renewed and introduction of labor-saving machinery, without which the betterment of the agricultural system is impossible.

[1] Agroklimatische Verhältnisse Russlands. Der Kulturtechniker, Zeitschrift der Deutschen Kulturtechnischen Gesellschaft. XXXI Jahrg. Heft Nr. 6 Breslau. 1928. Translation of conclusions.—*W. W. Reed.*